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## NORTHERN REGIONAL RESEARCH LABORATORY

# PUBLICATIONS AND PATENTS

January-June 1974

Agricultural Research Service  
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## REQUEST FOR INFORMATION

Results of research investigations at the Northern Regional Research Laboratory are published regularly in the technical literature, and public-service patents are secured to cover patentable inventions and discoveries (see page 58). As a convenient guide to our publications and patents, a list with abstracts is published semiannually. These abstracts describe the current research and indicate the progress achieved. Further information on any of the developments, as well as earlier technical papers, may be obtained by writing us.

In conformance with the policy of the U.S. Department of Agriculture, Northern Laboratory publications are available to scientists and other specialists, librarians, representatives of the press, and others interested.

Reference to commercial equipment or proprietary products is made as part of the exact experimental conditions. Naming a company or product does not imply approval or

recommendation by the U.S. Department of Agriculture over others not mentioned.

Requests for specific reprints should be by number and addressed to the Northern Regional Research Laboratory. Those titles marked with an asterisk [\*] are not available at the Northern Laboratory for distribution.

Most of the publications are in journals that are available in libraries. Photographic copies of most journal articles on research at this Laboratory can be purchased from the National Agricultural Library of the U.S. Department of Agriculture, Beltsville, Maryland 20705.

No publications will be sent regularly in response to foreign requests unless exchange arrangements have been made with the Director of the National Agricultural Library.

Copies of previous lists of publications and patents are available upon request.



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## PUBLICATIONS

[Publications marked with an asterisk (\*) are not available for distribution at the Northern Regional Research Laboratory. When requesting reprints, please order by number. Use your zip code.]

- 3436 • A Readability Survey of Technical and Popular Literature  
William F. Kwolek<sup>1</sup>  
(<sup>1</sup>Biometrician, North Central Region, ARS, USDA, Peoria, Ill.)  
Journalism Quarterly 50(2): 255-264. 1973

Based on results for more popular categories in this survey a Fog Index of 11 appears acceptable to most adults. Literature with a Fog Index value greater than 14 will likely be ignored unless the reader has special interest, motivation, or education.

There is evidence of two-unit increase in the Fog Index over the last 20 years. As writing styles change with time, changes in the coefficients of readability formulas are to be expected. There was no basis for changing the manner of computing the Fog Index but there was some evidence that words per sentence should be given less weight than hard words. The percent hard words increased as the length of the sentence increased. The Fog Index is a simple convenient measure for studying readability for a wide range of literature.

- 3437 • Sporulation of *Bacillus thuringiensis* Without Concurrent Derepression of the Tricarboxylic Acid Cycle  
Kenneth W. Nickerson, John DePinto, and Lee A. Bulla, Jr.  
J. Bacteriol. 117(1): 321-323. January 1974

*Bacillus thuringiensis* sporulates in a glucose-glutamate medium without concurrent derepression of the tricarboxylic acid cycle. Glutamate appears to regulate tricarboxylic acid cycle activity, as well as to influence spore heat resistance and production of dipicolinic acid.



- 3438 • Soybean Proteins: Their Production, Properties, and Food Uses. A Selected Bibliography  
W. J. Wolf  
J. Amer. Oil Chem. Soc. 51(1): 63A-66A. January 1974

Key references have been assembled to serve as an introduction to the literature on production, properties, and food uses of soybean proteins.

- 3439 • Biological and Physiological Factors in Soybeans  
Joseph J. Rackis  
J. Amer. Oil Chem. Soc. 51(1): 161A-174A. January 1974

There are limitations to which one is justified in drawing broad generalizations concerning the diverse biological and physiological effects of soy protein products. Nevertheless, there appear to be two distinct situations: (a) Proper heat treatment exerts a beneficial effect upon the nutritive value of whole soybeans, full-fat and defatted meal. Associated with proper heating is inactivation of trypsin inhibitor and other heat-labile factors and conversion of raw refractory proteins to forms that are more readily digested. (b) Moist heat also has a beneficial effect upon the nutritive value of soy protein isolates. However, a deficiency of certain essential nutrients and the interaction of phytic acid with protein, vitamins, and minerals during processing are the primary factors responsible for the poor nutritive value of soy isolates. Occasionally mineral deficiency symptoms do occur in animals fed soybean meal. It is a misnomer to refer to the growth-inhibiting and pancreatic hypertrophic properties as a "toxic" effect since both properties are reversible. Modern analytical techniques should be used to reinvestigate the relationship between phytic acid and availability of minerals and vitamins in soy protein isolate diets. Research also is needed to determine more accurately vitamin and mineral contents of soy protein isolates and the availability of vitamins and minerals in soy protein concentrates. Breeding soybean varieties genetically deficient in anti-nutritional and nonflatulent factors does not appear promising. More research is needed to determine whether fermentation and enzyme processes can be used to prepare flatulent-free soy products. Minor factors to be considered in assessing the nutritive value of soy products include a weak goitrogen present in soybeans, and a very low estrogenic activity.

- 3440 • Molecular-Sieve Chromatography of Amylose and Dextran Over Porous Glass  
F. R. Dintzis and R. Tobin  
J. Chromatogr. 88(1): 77-85. January 1974

Porous glass of 370 Å average pore diameter is useful for fractionating amylose and dextran of weight average molecular weights ranging from  $2 \times 10^4$  to  $2 \times 10^5$  and at flow rates of 12-14 ml/hour at room temperatures. The

universal calibration concept of equivalent hydrodynamic volumes in solution is valid for amylose and dextran in 95% methyl sulfoxide-5% H<sub>2</sub>O or 4M guanidine hydrochloride as solvents; hence, commercially available dextran fractions may serve to calibrate the column. Polystyrene fractions in tetrahydrofuran exhibit a different calibration curve. Thus the universal calibration concept does not appear to be valid for all three polymers in our column.

- 3441 • Synthesis of Deoxyharringtonine<sup>1</sup>  
 K. L. Mikolajczak, C. R. Smith, Jr., D. Weisleder, T. Ross Kelly,<sup>1</sup>  
 J. C. McKenna,<sup>1</sup> and P. A. Christenson<sup>1</sup>  
 (<sup>1</sup>Boston College, Chestnut Hill, Mass.)  
 Tetrahedron Lett. (3): 283-286. January 1974

The first successful conversion of cephalotaxine to one of its natural anti-tumor esters is reported. An isolation technique whereby deoxyharringtonine is separated from a diastereomer produced as a byproduct is also described. Treatment of ethyl *t*-butyl oxalate with the lithium acetylide of 3-methyl-1-

butyne gives the acetylenic  $\alpha$ -keto ester,  $(\text{CH}_3)_2\text{CHC}\equiv\text{C}-\overset{\text{O}}{\parallel}\text{C}-\overset{\text{O}}{\parallel}\text{C}-\text{O}-t\text{-Bu}$ . Hydrogenation of this ester followed by reaction with trifluoroacetic acid yields the corresponding saturated  $\alpha$ -keto acid. Conversion of this acid to its acid chloride and subsequent reaction with cephalotaxine gave the desired  $\alpha$ -keto ester, which was then treated with  $\text{LiCH}_2\text{CO}_2\text{CH}_3$ . This reaction afforded a 15% recovered yield of the two diastereomeric esters. They were separated and purified by preparative TLC, first with preparative plates and then with analytical plates by a double development technique.

- 3442 • Sporogenicity of Yeast Autolyzates and Casein Hydrolyzates for *Bacillus popilliae* in Liquid Cultures  
 William C. Haynes and Clarence D. Crowell  
 J. Invertebr. Pathol. 22(3): 377-381. November 1973

*Bacillus popilliae* NRRL B-2309S forms several million refractile spores per milliliter in liquid shaken cultures. A suitable medium includes glucose, K<sub>2</sub>HPO<sub>4</sub>, water, and three selected ingredients--activated carbon, a yeast autolyzate, and a casein hydrolyzate. Only 4 out of 26 lots of commercial yeast autolyzates tried were sporogenic. Even then, spore formation in the presence of the four was poor and erratic unless a compatible casein hydrolyzate also was present. Five of eight lots of casein hydrolyzates improved the sporogenicity of selected yeast products to various degrees. A comparison of amino acid compositions of yeast and casein lysates sheds no light on differences between suitable and unsuitable ones. Less refined yeast and casein products seem preferable.



- 3443 • Aflatoxin and Trichothecene Toxins: Skin Tumor Induction and Synergistic Acute Toxicity in White Mice  
L. A. Lindenfelser, E. B. Lillehoj, and H. R. Burmeister  
J. Nat. Cancer Inst. 52(1): 113-116. January 1974

Toxic interactions of three naturally occurring mycotoxins were examined by the mouse skin tumor test and by acute toxicity trials. Aflatoxin B<sub>1</sub> functioned as a tumor-initiating substance; a single 25-μg dose applied before croton oil as promoter caused papilloma formation on more than half the test animals. Neither *Fusarium* toxin, T-2 toxin or diacetoxyscirpenol, served as initiating agents. These two mycotoxins acted as weak promoter substances on 7,12-dimethylbenz[α]-anthracene (DMBA)-initiated mouse skin cells but not on mice treated with B<sub>1</sub> as initiator. Either DMBA or B<sub>1</sub> initiation followed by T-2 promotion (25 μg/dose) caused extensive skin damage and subsequent tolerance of the treated skin to elevated doses of T-2. In acute toxicity trials, combinations of B<sub>1</sub> and T-2 produced a synergistic lethal response.

- 3444 • Physiological and Morphological Correlation of *Rhizopus stolonifer* Spore Germination  
James L. Van Etten,<sup>1</sup> Lee A. Bulla, Jr., and Grant St. Julian  
(<sup>1</sup>University of Nebraska, Lincoln)  
J. Bacteriol. 117(2): 882-887. February 1974

Sporangiospores of *Rhizopus stolonifer* were examined during germination and germ tube development by scanning electron and phase-contrast microscopy. Also determined were changes in spore dry weight and spore volume, O<sub>2</sub> consumption, and synthesis of deoxyribonucleic acid, ribonucleic acid, and protein. These studies reveal that development of a mycelium from a sporangiospore follows a sequence of events involving dramatic morphological and biochemical modifications. These changes involve: the specific timing of initiation of deoxyribonucleic acid, ribonucleic acid, and protein synthesis; the onset of O<sub>2</sub> consumption; increase in cell weight and volume and subsequent constancy of these properties; spore swelling, elongation, and germ tube emergence; and differential alteration of the germ tube, its parent sporangiospores, and the germ tube tip. The data reported establish that protein synthesis and ribonucleic acid synthesis begin simultaneously and immediately upon initiation of germination.

- 3445 • Gamma-Irradiated Corn Starches. Alkaline Dispersions for Surface-Sizing Paper  
B. T. Hofreiter and C. R. Russell  
Staerke 26(1): 18-23. January 1974

Corn starch was depolymerized by gamma irradiation (cobalt 60, approximately 1.25 Mrads/hour) to prepare reduced viscosity products for surface-sizing

paper. The general effects of irradiation were determined on the extent of starch degradation, as well as dispersion variables. Low levels of irradiation, 0.02 to 0.5 Mrad, had a profound influence on granule swelling and disruption at a pasting temperature of about 90° C. as determined in a recording viscometer. Product properties are affected considerably by carbonyl and carboxyl groups even when introduced at levels below 1 mmole/100 g. Carbonyl groups impart alkali sensitivity that produces significant degradation during dissolution in stoichiometric quantities of alkali. Carboxyl groups in starch paper sizes are determined because they act as dispersants for fines and fillers in repulped paper. Apparently dispersion in alkali is the most effective way to utilize irradiated starches as surface-sizing agents. Corn starch irradiated to 2 Mrads and dispersed in alkali improved paper properties as well as a high-quality commercial product.

3446 • Crambe Thioglucoside Glucohydrolase (EC 3.2.3.1): Separation of a Protein Required for Epithiobutane Formation

H. L. Tookey

Can. J. Biochem. 51(12): 1654-1660. December 1973

Sonicated extract of crambe seed meal prepared in the presence of ferrous ion and dithiothreitol enzymatically converts *epi*-progoitrin to glucose,  $\text{HSO}_4^-$ , and a mixture of 1-cyano-2-hydroxy-3,4-epithiobutanes (50-70%) and 1-cyano-2-hydroxy-3-butene (30-50%). A fraction of the extract precipitating between 60 and 70% saturated ammonium sulfate contains thioglucosidase that converts *epi*-progoitrin essentially to 1-cyano-2-hydroxy-3-butene. Chromatography (on crosslinked dextran) of a 40-60% ammonium sulfate fraction leads to separation of a proteinaceous material ( $S_{20} = 2.6S$ ) that does not hydrolyze *epi*-progoitrin but, in the presence of thioglucosidase, promotes the formation of 1-cyano-2-hydroxy-3,4-epithiobutanes in amounts proportional to those from crude seed meal extract.

3447 • Soybean Phosphatidylcholine Develops Bitter Taste on Autoxidation

D. J. Sessa, K. Warner, and D. H. Honig

J. Food Sci. 39(1): 69-72. January-February 1974

Soybean phosphatidylcholine (SPC) and hydrogenated SPC were isolated by column chromatography from commercial lecithin and hydrogenated lecithin<sup>††</sup>, respectively. Aqueous suspensions of these preparations with added Cu were stored at 25° C. A seven-member taste panel rated dilutions containing 0.1% phospholipid for intensity of bitterness, based on the scoring system: 0 = none to 3 = strong. Both SPC and hydrogenated SPC initially rated a score of 0.8. A score of 1.6 was given when a suspension of SPC exhibited maximum absorbance due to diene conjugation. The score increased to 3.0 after 4 weeks of storage. The development of bitter taste appeared to be



associated with extent of oxidation of SPC as determined by thiobarbituric acid assay. Since no changes in taste occurred with hydrogenated SPC treated similarly, bitterness development is attributed to autoxidation of the constituent unsaturated fatty acids.

3448 • High-Lysine Corn Fractions and Their Characteristics

G. N. Bookwalter, K. Warner, O. L. Brekke, and E. L. Griffin, Jr.  
J. Food Sci. 39(1): 166-170. January-February 1974

The protein of high-lysine (*opaque-2*) corn is nutritionally superior to that of normal yellow dent corn because it contains a higher ratio of limiting amino acids. Studies were carried out with high-lysine corn, which is deficient in horny endosperm as compared to dent corn. Corn was milled to grits, meal, flour, and degermer fines, and investigations of these fractions included: color, storage stability, visco-amylograph characteristics, and food applications.

Color values of dent fractions showed more yellow and were darker than those of high lysine. All fractions displayed adequate stability for 56 days at 120° F. and for 182 days at either 77° or 100° F. as determined by changes in available lysine, fat acidity, and flavor. High-lysine grits had lower pasting temperatures than dent grits. Hot paste and setback viscosities were higher for high-lysine fractions. Fermentations were more active for uncooked dent than for high-lysine fractions, but the trend reversed after precooking. Extrusion-cooked high-lysine fractions exhibited greater expansion and higher water solubility than dent. Baking characteristics were similar when comparisons were made with flour and fines from high-lysine and dent in pancakes and high-lysine and dent meals in corn bread.

3449 • A New Soy Lipid-Protein Concentrate for Beverages

G. C. Mustakas  
Cereal Sci. Today 19 (2): 62-64, 69-73. February 1974

A lipid-protein concentrate (LPC) has been isolated in 94% protein yield by a simple direct process from soybeans. In the procedure, LPC was isolated from full-fat soy flour by isoelectric acid wash at pH 3.5. An acid cook was introduced to inactivate lipooxygenase so that lipid oxidation would not occur and thereby develop off-flavors. Soluble carbohydrates and other water-soluble constituents were removed in a whey fraction during centrifugation. After redispersion in water, the LPC was cooked for 1 minute at pH 9.0 to completely inactivate growth inhibitors and improve the nutritional quality of the protein. Wet-milling in a colloid mill and homogenizing reduced the LPC to a fine particle size and gave a product with excellent suspension properties in water. The resuspended concentrate yielded a drink that was very bland, had smooth mouth-feel, was low in viscosity, and

had other desirable beverage characteristics. With the addition of other nutrients such as fat, minerals, vitamins, and synthetic flavors, a great variety of high-quality beverages are possible. The liquid product can be spray-dried to a reconstitutible powder, if desired, for convenience and for reduced shipping costs.

3450 • Oxidation and Quality of Soybean Oil: A Preliminary Study of the Anisidine Test

G. R. List, C. D. Evans, W. F. Kwolek,<sup>1</sup> K. Warner, B. K. Boundy, and J. C. Cowan

(<sup>1</sup>Biometrician, North Central Region, ARS, USDA, Peoria, Ill.)

J. Amer. Oil Chem. Soc. 51(2): 17-21. February 1974

The anisidine test, a measure of secondary oxidation products in glyceride oils, was applied to a number of soybean salad oils processed from sound and damaged soybeans. A highly significant correlation (-0.68) was found between the anisidine values of salad oils from sound soybeans and their flavor scores. Multiple correlations between flavor scores, anisidine, and peroxide values yielded a correlation of 0.81 and provided a method for predicting the initial flavor scores of sound soybean salad oils. Similar data for oils from damaged beans gave a highly significant, but lower, correlation (-0.65). Comparative studies indicated that sound crude oils usually contain lower levels of oxidation products than damaged crude. Oxidation in both sound and damaged crudes increased roughly in proportion to iron content. Reproducibility of the test and the effects of hydrogenation, accelerated storage, and fluorescent light on anisidine values were studied. Analysis of damaged oils before and after deodorization showed that little, if any, reduction of anisidine value occurred. Deodorization of sound oils, however, lowered anisidine values. In comparison with damaged oils, the anisidine values of sound oils were lower at comparable stages of processing. The poor quality of damaged soybean oil was substantiated by organoleptic evaluations. Flavor scores of oils given special processing treatments increased as anisidine values decreased.

3451 • Infrared Absorption of Methyl *cis*-9,*trans*-11, and *trans*-10,*cis*-12-Octadecadienoates

C. R. Scholfield

J. Amer. Oil Chem. Soc. 51(2): 33-34. February 1974

The ratio of absorptivity at 10.2  $\mu\text{m}$  and 10.6  $\mu\text{m}$  differs between methyl *cis*-9,*trans*-11- and *trans*-10,*cis*-12-octadecadienoates. For the *cis*-9,*trans*-11-ester,  $a_{10.2 \mu\text{m}}/a_{10.6 \mu\text{m}}$  is in the range of 1.1-1.2; for the *trans*-10,*cis*-12-ester, it is 1.3-1.4. These differences in absorptivities are great enough to affect significantly compositions calculated from infrared absorption.



- 3452 • Replication of Virus-Like Particles in *Penicillium stoloniferum* Mycelia  
 R. W. Detroy, E. B. Lillehoj, and C. W. Hesseltine  
 Can. J. Microbiol. 20(2): 113-117. February 1974

Direct extraction of nucleic acid from mycelium of *Penicillium stoloniferum* yielded five viral double-stranded ribonucleic acid (dsRNA) components, transfer RNA (tRNA), and a deoxyribonuclease-sensitive fraction of deoxyribonucleic acid. Analysis of fungal cells from a submerged fermentation demonstrated detectable viral dsRNA and both types of virus-like particles (VLP) at 36 hours with an increase in viral RNA synthesis for both VLP parallel to fungal growth up to 72 hours followed by mycelial autolysis and loss of viral RNA. Replication of nucleic acid from VLP was measured by (i) incorporation of  $^{14}\text{C}$ -2-uracil into viral dsRNA, (ii) purification of viral dsRNA by cellulose column chromatography and subsequent ultraviolet absorption determination, and (iii) analysis of nucleic acid species by polyacrylamide gel electrophoresis.

- 3453 • Starch-Based Film for Degradable Agricultural Mulch  
 Felix H. Otey, Arthur M. Mark, Charles L. Mehlretter, and  
 Charles R. Russell  
 Ind. Eng. Chem. Prod. Res. Develop. 13(1): 90-92. March 1974

Several starch-based films were prepared and evaluated as degradable agricultural mulch. The films were made by casting a water dispersion of starch, poly(vinyl alcohol), glycerol, surfactant, and formaldehyde onto glass plates, oven drying, and coating the films with poly(vinyl chloride) or a copolymer of vinylidene chloride and acrylonitrile. The films have 2,000-3,000 p.s.i. tensile strength, 10-150% elongation, and resistance to artificial weathering of 40-120 hours. The range of properties is controlled by the ratios of coatings, plasticizer, and crosslinking agent.

- 3454 • Sodium Dodecyl Sulphate-Sodium Chloride Extraction of *Penicillium stoloniferum* Mycelium for Viral Double-Stranded RNA  
 E. B. Lillehoj, R. W. Detroy, and C. W. Hesseltine  
 J. Gen. Microbiol. 80(2): 329-337. February 1974

Incubation of mycelia of a virus-containing strain of *Penicillium stoloniferum* in a 1% sodium dodecyl sulphate-4% sodium chloride (SDS-NaCl) solution liberated protein and deoxyribonucleic acid within the first hours, whereas ribonucleic acid (RNA) release continued through an extended period. Although transfer RNA (tRNA) was readily solubilized by the treatment, viral double-stranded RNA (dsRNA) was not detected in the extracellular lysate during the initial 6 hours of incubation. After 24 hours of treatment,

mechanical disruption of the mycelia liberated some dsRNA; this procedure demonstrated the incomplete solubilization of viral nucleic acid in SDS-NaCl. Scanning electron micrographs of mycelium treated with a salt-detergent mixture showed progressive reduction in structural integrity of fungal hyphae. However, hyphal tips appeared to remain morphologically intact during incubation.

- 3455 • Lactic Acid Fermentation of Soybean Milk  
Hwa L. Wang, Lavanaya Kraidej, and C. W. Hesselstine  
J. Milk Food Technol. 37(2): 71-73. February 1974

Growth rates of eight *Lactobacillus acidophilus* strains and four *Lactobacillus bulgaricus* strains were compared in soybean milk and soybean milk enriched with glucose, lactose, and sucrose. Four *L. acidophilus* strains grew well in soybean milk; the remainder grew better in soybean milk supplemented with glucose or lactose. In general, soybean milk was not an adequate media for strains of *L. bulgaricus*. Almost all these cultures, however, could adapt themselves to the environments of the media tested. A soybean milk drink fermented by *L. acidophilus* NRRL B-1910 was prepared and evaluated by a taste panel. The drink had a refreshing sweet-sour taste, and the beany flavor of soybeans was masked by the fermentation process.

- 3456 • The Facile Oxidation of Thiols to Disulfides with Dithiobis(thioformates)  
E. I. Stout, B. S. Shasha, and W. M. Doane  
J. Org. Chem. 39(4): 562-563. February 1974

A simple procedure for the oxidation of thiols is described in which all byproducts of the reaction are volatile. Therefore, the disulfide is obtained in near quantitative yield by evaporation of these volatile components.

- 3457 • Alkaloids of *Cephalotaxus harringtonia* var. *drupacea*. 11-Hydroxycephalotaxine and Drupacine  
Richard G. Powell, Richard V. Madrigal, Cecil R. Smith, Jr., and Kenneth L. Mikolajczak  
J. Org. Chem. 39(5): 676-680. March 1974

Two isomeric alkaloids, 11-hydroxycephalotaxine (I) and drupacine (II), have been isolated from *Cephalotaxus harringtonia* var. *drupacea* (Sieb. + Zucc.) Koidzumi. Evidence is presented in support of structures assigned to these alkaloids. Close proximity of the two hydroxyl functions of I leads to some unusual reaction products. Nearly quantitative conversion of I and II occurs



under mild acidic conditions. Treatment of I with tosyl chloride in pyridine affords a cyclic ether, and oxidation of I under modified Oppenauer conditions forms an intramolecular hemiketal. The diacetate of I is epimerized under extraordinarily mild conditions.

- 3458 • Publications and Patents of the Northern Regional Research Laboratory, July-December 1973  
North. Reg. Res. Lab., ARS, USDA, 66 pp. [February 1974]

- 3459 • Processing and Products  
J. C. Cowan  
*In* "Soybeans: Improvement, Production, and Uses," B. E. Caldwell, ed., chap. 20, pp. 619-664. American Society of Agronomy, Madison, Wisconsin. 1973

These aspects of soybean processing and use are covered in this chapter: handling and storage, preparation of flakes, extraction, desolventizing-toasting, degumming, refining, bleaching, deodorization, hydrogenation, salad and cooking oils, flavor stability, shortening, margarine, specialty fats, lecithin, essential fatty acids, industrial nonfood uses, meal for livestock and poultry, nutritional aspects of meal and flour, soy flour, protein concentrates and isolates, textured meal-like products, and fermented and other specialty foods.

- 3460 • Food Polysaccharides Produced by Fermentation  
Dwight L. Miller  
*In* "Current Topics in Food and Nutrition--1970," Proc. Workshop, University of Iowa, Iowa City, June 15-July 2, 1970, eds E. M. Osman and M. O. Osborn, pp. 120-135. [1973]

The importance of gums to man has been evident since before recorded history. The types of gums available have now evolved from the original, natural, crude plant exudates to the completely synthetic, tailor-made products of today.

Microbial gums, produced by the fermentation of such natural raw materials as starch and sucrose, have been developed in modern times, and they have become commercially important. Xanthan gum (B-1459) has been approved by FDA for food uses. Preliminary probing tests have indicated that related microbial gum products may also be nontoxic.

An increasing consideration of national importance is the unstable world situation. The U.S. import of many world gums could be lost on short notice.

The United States can now meet the requirements of food polysaccharides through fermentation of readily available domestic raw materials. We are no longer dependent in times of emergency on imported materials.

- 3461 • Two New Families of Mucorales  
J. J. Ellis and C. W. Hesseltine  
Mycologia 66(1): 87-95. January-February 1974

Two new families of Mucorales are described. *Saksenaeaceae* Hesseltine & Ellis is typified by *Saksenaea* Saksena and includes *Echinosporangium* Malloch. *Radiomycetaceae* Hesseltine & Ellis is typified by *Radiomyces* Embree and includes *Hesseltinella* Upadhyay. Characteristics of the genera are summarized.

- 3462 • Thiolation with Inversion at Secondary Positions During Fragmentation-Rearrangement of Sugar Dithiobis(thioformates)  
Baruch S. Shasha, Donald Trimmell, and William M. Doane  
Carbohydr. Res. 32(2): 349-359. February 1974

Cyclic dithiobis(thioformates) derived from vicinal *trans*-diols decomposed upon pyrolysis or upon treatment with methyl sulfoxide containing catalytic amounts of base to give *O,S*-dithiocarbonates with accompanying inversion at the site of thiolation. With derivatives of vicinal *cis*-diols, fragmentation led only to thionocarbonates and the parent diols. Cyclic dithiobis(thioformates) of methyl 4,6-*O*-benzylidene- $\alpha$ -D-glucopyranoside, 1,2:5,6-di-*O*-isopropylidene-D-mannitol, and *trans*-1,2-cyclohexanediol decomposed to *O,S*-dithiocarbonates; whereas the dithiobis(thioformates) of methyl 4,6-*O*-benzylidene- $\alpha$ -D-mannopyranoside and *cis*-1,2-cyclohexanediol decomposed only to thionocarbonates and the corresponding diols. The structures of the *O,S*-dithiocarbonates were confirmed by physical and chemical data.

- 3463 • Denaturation of Plant Proteins Related to Functionality and Food Applications. A Review  
Y. Victor Wu and George E. Inglett  
J. Food Sci. 39(2): 218-225. March-April 1974

Proteins can be denatured by heat, changes in pH, organic solvents, detergents, urea, guanidine hydrochloride, or other methods that modify the secondary, tertiary, or quaternary structure without breaking any covalent bonds. Physical-chemical measurements or functionality related to denaturation include solubility, viscosity, dissociation into subunits, sedimentation constant, optical rotation, association, and ultraviolet spectra. The relationship between pH, temperature, and rate of denaturation of wheat and soy proteins is complex. Optimum heat treatment of soy flakes, for example,



inactivates nearly all biological active components, but the protein retains most of its functionality. Knowledge about protein denaturation helps to produce food products with desirable functional properties.

- 3464 • Selective Hydroformylation of Unsaturated Fatty Acid Esters  
E. N. Frankel  
Ann. N.Y. Acad. Sci. 214: 79-93. June 1973

Although hydroformylation of unsaturated fatty acids from vegetable oils or from animal fats with conventional cobalt catalysts has received some attention, the process has not been adopted commercially. At the Northern Laboratory, the selectivity of hydroformylation catalysts is being studied to prepare either a high proportion of linear products or simple branched products from unsaturated fats and fatty acids. This paper reviews some catalyst studies designed for developing an economic process and product studies aimed at finding industrial applications for the various hydroformylation derivatives.

- 3465 • Allylic Prepolymers from Brassylic and Azelaic Acids  
Shu-Pei Chang, Thomas K. Miwa, and William H. Tallent  
J. Appl. Polym. Sci. 18(2): 319-334. February 1974

Diallyl brassylate (DAB), a new monomer, and diallyl azelate (DAA) were converted to new prepolymers for comparison with analogous commercial products from diallyl *O*- and *m*-phthalate (DAMP). Respective prepolymers from DAB and DAA had  $\bar{M}_n$  28,000 and 40,000 and contained approximately 0.8 free allyl moiety per repeating unit. Only the DAB prepolymer exhibited crystallinity at low temperatures as detected by differential scanning calorimetry and x-ray diffraction. Aliphatic prepolymers have greater heat stability than aromatic ones and evolve fewer calories per double bond during curing than reported for DAMP prepolymer. Low shrinkage (<1%) on curing and clear, hard end products indicate the potential of aliphatic prepolymers as thermosetting plastics. Their liquid state at room temperature should be advantageous in many applications.

- 3466 • Instability of Solutions of Amylose-Iodine Complex in Concentrated Calcium Chloride  
F. R. Dintzis  
Staerke 26(2): 56-58. February 1974

Low concentrations of amylose-iodine complex, in general, are insoluble in aqueous concentrated calcium chloride. However, lightly substituted

hydroxyethyl amylose-iodine complex is soluble and stable in aqueous concentrated calcium chloride for at least a few days. The color stability of some iodine complexes of derivatized amylose and starch is observed to be time dependent.

- 3467 • Starch Xanthide in Handsheets and Machine-Made Papers  
G. E. Lauterbach,<sup>1</sup> E. J. Jones,<sup>1</sup> J. W. Swanson,<sup>1</sup> B. T. Hofreiter,  
and C. E. Rist  
(<sup>1</sup>Institute of Paper Chemistry, Appleton, Wis.)  
Staerke 26(2); 58-66. February 1974

Starch xanthide, an internal adhesive for paper, imparts high levels of wet strength along with improved dry strength. Laboratory quantities of starch xanthide, degree of substitution of 0.12, were prepared and used in handsheets to evaluate incorporation procedures. The quality of these handsheets was compared with that of machine-made papers containing starch xanthide formed by a continuous process. Results showed that starch xanthide should be produced as a disperse system of insoluble particles and that large coagulated particles are less effective than small ones in changing the properties of paper. Rapid blending of starch xanthate and acidified sodium hypochlorite crosslinking reagent improves the performance of the resulting starch xanthide dispersions and reduces the amount of oxidant needed. Starch xanthide dispersions at a concentration of 0.125%, to avoid premature coagulation, are best added after alum has been blended with pulp fibers. Up to 10% starch xanthide was incorporated in handsheets made from a number of pulps.

- 3468 • A Rapid Turbidimetric Analysis for Zein in Corn and Its Correlation with Lysine Content  
Jerrold W. Paulis, Joseph S. Wall, and William F. Kwolek<sup>1</sup>  
(<sup>1</sup>Biometrician, North Central Region, ARS, USDA, Peoria, Ill.)  
J. Agr. Food Chem. 22(2): 313-317. March-April 1974

A rapid, simple, and inexpensive method has been developed for estimating lysine in corn of normal and high-lysine types. The procedure is based on an inverse correlation of the zein content with percentage lysine in protein. Zein is determined turbidimetrically after being precipitated from solution in 70% ethanol-0.5% sodium acetate extracts of either meals of whole grain or endosperm. Optimum conditions have been established by which quantitative extraction of zein from corn meals is rapid. The influences of germ, lipid, and age of meal upon the development of turbidity in extracts were determined. By use of a reciprocating shaker to prepare extracts, a single technician can complete analysis of 40 ground and weighed samples in 7 hours. For 37 different whole corn meals, correlation coefficients for absorbance



at 590 nm per gram of protein of turbid extracts to percentage lysine in proteins were -0.87 and for 17 endosperms -0.89.

- 3469 • Selection of High-Lysine Corns with Varied Kernel Characteristics and Compositions by a Rapid Turbidimetric Assay for Zein  
 Jerrold W. Paulis, Joseph S. Wall, William F. Kwolek,<sup>1</sup> and Gary L. Doanldson  
 (<sup>1</sup>Biometrician, North Central Region, ARS, USDA, Peoria, Ill.)  
 J. Agr. Food Chem. 22(2): 318-323. March-April 1974

Breeders are discovering and developing new high-lysine corns that have improved kernel characteristics, different starch types, and elevated protein levels. Because of the varied physical characteristics of these grains, an easy method for estimating lysine in corn is required to select corn with better protein quality. Our rapid turbidimetric assay of zein in extracts of meal was tested as a means of estimating lysine on a large number of whole corn and endosperm meals. The meals were from grains varying considerably in hardness and composition. High-oil, high-protein, high-amylose, *sugary-2*, *brittle-2*, and combinations of *sugary-2* and *waxy* with *opaque-2* and other corns were analyzed. A highly significant negative correlation was found between lysine content of the protein and zein content of the meal, a correlation similar to that observed for normal, *opaque-2*, and *floury-2* grains. The method has been used successfully to select high-lysine grains from among vitreous kernels having *opaque-2* backgrounds. These results demonstrate the applicability of our turbidimetric analysis of zein for estimating lysine in corn in breeding programs and for distinguishing high-lysine grain in commerce.

- 3470 • Sweeteners: New Challenges and Concepts  
 G. E. Inglett  
 In "Symposium: Sweeteners," ed. G. E. Inglett, chap. 1, pp. 1-9. Westport, Conn. 1973

The major sweeteners, worldwide, are sucrose and corn sugars. Dextrose, except that which forms half of invert sugar, and corn syrup (dextrose syrup) are products derived from starch by hydrolysis. Starch suitable for the manufacture of dextrose and syrup may come from any one of numerous plant sources although corn is the most important source in the United States.

A challenging area of sweetener development is the preparation of various new kinds of syrups. The supersweetness of the fruit of *Dioscoreophyllum cumminsii*, called the serendipity berry, was recognized in 1968. The macromolecular properties of the *D. cumminsii* sweetener was found in 1967 and

reported to be a protein in 1972. The macromolecules responsible for sweetness either by modification of taste (miracle fruit) or direct sweetness (serendipity berry, katemfe) must have a portion of their structure that is essential for the sweet taste. The sweetness probe of the miracle fruit's active principle may lie in its bonding between the carbohydrate moiety and the protein chain. Since the *D. cumminsii* sweetener acts directly on the taste buds as a probe, a peptide linkage analogous to the aspartic acid sweeteners may be an essential element. As an extension of the sweetness probe theory, chemical structures were examined of the super-sweeteners--stevioside, glycyrrhizin, osladine, and the dihydrochalcones. The challenge of finding an innocuous supersweetener with the taste quality of sucrose is a formidable objective.

- 3471 • Structural Aspects of Glycosidic Sweeteners Containing (1'→2)-Linked Disaccharides  
J. E. Hodge and G. E. Inglett  
In "Symposium: Sweeteners," ed. G. E. Inglett, chap. 20, pp. 216-234. Westport, Conn. 1973

The molecular structures of five intensely sweet glycosides, and of a sixth glycoside known to block sweet taste, are reviewed and correlated. Each sweet glycoside contains: (1) A disaccharide with an internal (1'→2)-O-glycosidic linkage; (2) an extended, hydrophobic aglycone; and (3) a second, critical hydrophilic group at the opposite end of the aglycone from the hydrophilic disaccharide. This structural correlation should promote the search for a new low-caloric sweetener to replace those of doubtful healthfulness.

- 3472 • Extraction of Soybean Proteins with Aqueous 2-Mercaptoethanol  
A. M. Nash, W. F. Kwolek,<sup>1</sup> and W. J. Wolf  
(<sup>1</sup>Biometrician, North Central Region, ARS, USDA, Peoria, Ill.)  
Cereal Chem. 51(2): 220-227. March-April 1974

Water, 0.01M, and 0.1M 2-mercaptoethanol extracts of fresh and aged defatted soybean meals were equilibrated, either directly or after 10% sodium chloride solution-distilled water dialysis, with pH 7.6, ionic strength 0.5 buffer with and without 0.01M 2-mercaptoethanol. Kjeldahl and ultracentrifugal analyses of the extracts showed that reductant in the extraction medium increased protein extractability; mainly additional 7S and 11S proteins were solubilized. A portion of these proteins apparently exists in defatted meal as water-insoluble disulfide polymers that are depolymerized and solubilized by 2-mercaptoethanol. Ultracentrifugal analyses of the water extracts in buffer with and without 0.01M 2-mercaptoethanol also revealed significant amounts of water-soluble disulfide polymers of the 7S fraction. Similar analyses of the reductant extracts indicated that the 7S and 11S



fractions repolymerized partially during dialysis against buffer to remove the reducing agent except when aged meals were extracted with 0.1M 2-mercaptoethanol. Exhaustive dialysis of the extracts against salt followed by distilled water failed to increase disulfide repolymerization over amounts obtained on shorter-term dialysis against buffer. Rather, losses of protein and changes in protein distribution occurred; generally, the 2S fraction increased and the 7S and 11S fractions decreased on exhaustive dialysis.

- 3473 • Wheat Glutenin Subunits. I. Preparative Separation by Gel-Filtration and Ion-Exchange Chromatography  
F. R. Huebner and J. S. Wall  
Cereal Chem. 51(2): 228-240. March-April 1974

A combination of gel-filtration and ion-exchange chromatography was used to isolate two pure polypeptide subunits of wheat glutenin for the first time. In native glutenin polypeptide chains are linked by disulfide bonds to form a high-molecular-weight (MW) protein whose viscoelastic properties are important to wheat-flour dough behavior. After reductive cleavage of glutenin disulfide bonds the resulting sulfhydryl groups were alkylated with vinylpyridine to maintain stable polypeptide units. Electrophoretic comparison of reduced glutenin treated with various alkylating agents indicated the derivatives formed by the reaction with vinylpyridine were most suitable for the isolation experiments. Because of the complexity of the subunit mixture, a preliminary separation was made on crosslinked dextran with 0.03M acetic acid-4M urea. It yielded three distinct fractions, A, B, and C, of different MW ranges. Further fractionation of A and C by gel filtration in other systems provided additional resolution. The B and C fractions were chromatographed on sulfoethyl cellulose columns, using an increasing concentration of guanidine hydrochloride for elution. Some eluted peaks contained individual polypeptides while others had only two.

- 3474 • Wheat Glutenin Subunits. II. Compositional Differences  
F. R. Huebner, G. L. Donaldson, and J. S. Wall  
Cereal Chem. 51(2): 240-249. March-April 1974

Isolation of subunits from reduced wheat glutenin protein by new procedures has permitted detailed chemical and physical studies of them. The subunits were separated from *S*-pyridylethyl derivatives of reduced glutenin by gel filtration into three distinct groups (A, B, and C) which were resolved further by ion-exchange chromatography. Toluenesulfonic acid hydrolyzates of the isolated subunits were analyzed for amino acids by modified techniques of automated ion-exchange chromatography. Proteins from group A exhibited considerably more basic amino acids, as well as aspartic acid, than proteins in groups B and C. Much lower amounts of glutamic acid and proline were present in group A proteins than either the B and C group or gliadin proteins.

Some protein from group B contained the highest amount of glycine--almost six times more than either group C or the gliadins. Also, group B proteins were lower in valine, isoleucine, and phenylalanine than either A or C proteins. Group C proteins resemble gliadins in amino acid composition, except for a slightly higher content of cysteine. Aspartic and glutamic acids were major N-terminal groups of glutenin subunits from all fractions.

- 3475 • Defatted Corn-Germ Flour as a Nutrient Fortifier for Bread  
C. C. Tsen,<sup>1</sup> C. N. Mojibian,<sup>1</sup> and G. E. Inglett  
(<sup>1</sup>Kansas State University, Manhattan)  
Cereal Chem. 51(2): 262-271. March-April 1974

Defatted corn germ, rich in minerals and protein with lysine content more than twice that of normal wheat flour, is suitable as a nutrient fortifier for bread. Under optimum conditions, acceptable bread could be made from wheat flour fortified with 12% defatted corn-germ flour. In many countries where loaf volume is not emphasized, the fortified level could be raised to 24%. Defatted corn germ contains fewer sulfhydryl compounds than wheat germ. Accordingly, heat treatment and high dosage of oxidant were not required to improve the baking performance of the corn germ-fortified wheat flour. When ethoxylated monoglyceride, sodium stearyl-2 lactylate, sucrose monopalmitate, or sucrose tallowate was added, improvement was evident; in fact, no acceptable bread could be made from the fortified flour without the addition of one of these agents.

- 3476 • Sequential Gas Chromatographic Procedure for Microanalysis of Monoenoic Double Bond Position in Hydrogenated Oils  
E. A. Emken and H. J. Dutton  
Lipids 9(4): 272-278. April 1974

Quantitative cleavage of epoxyoctadecanoates with periodic acid ( $\text{HIO}_4$ ) has been demonstrated and the technique incorporated into an all gas chromatographic system for detailed lipid analysis. The overall procedure involves three sequential gas chromatographic separations interspersed by two micro-reactions. By this procedure, a complete analysis for *cis*- and *trans*-geometric isomers corresponding to each positional octadecenoate isomer is obtained. Total sample requirements are less than 10 mg., and the elapsed analysis time/sample is less than 10 hours. In this all gas chromatographic procedure, a lipid methyl ester sample is first separated by preparative gas chromatography, and the monoene fraction is collected and epoxidized. Next, the epoxidized sample is separated by gas chromatography into *cis*- and *trans*-epoxyoctadecanoate fractions. These epoxyoctadecanoate fractions are collected and cleaved with  $\text{HIO}_4$  into aldehyde and aldehyde-ester fragments which are quantitatively analyzed by gas chromatography. The double bond positions are determined from the aldehyde and aldehyde-ester cleavage data, which are



stored and processed by a computerized on-line gas chromatographic data acquisition system. The procedure was tested on pure octadecenoate isomers, standard mixtures, and commercially hydrogenated vegetable oils. Analyses of hydrogenated vegetable oils are compared with data acquired by reverse-phase and argentation chromatography followed by reductive ozonolysis.

3477 • Scanning Electron Microscopy of Conidiophore Ornamentations in *Aspergillus* Species

D. I. Fennell, G. St. Julian, L. A. Bulla, Jr., and F. L. Baker  
In "Scanning Electron Microscopy/1974 (Part II)," Proc. Workshop on SEM and the Plant Sciences, IIT Res. Inst., Chicago, Ill., pp. 413-420. April 1974

One criterion that serves, to a limited degree, to differentiate groups in the genus *Aspergillus* is roughening of conidiophore walls. Little exact information has been available on the true nature of these roughenings because any differences are difficult to distinguish under a light microscope. With a scanning electron microscope (SEM), we observed differences in conidiophore wall ornamentation that may prove useful in delineating major groupings within the genus.

We compared morphological characteristics of conidiophores of representative strains of species having roughened conidiophores in the *Aspergillus flavus*, *A. ochraceus*, *A. niger*, *A. sparsus*, *A. versicolor* groups. A limited number of species with smooth conidiophores also were studied. From information gained, there is little question that SEM provides an insight which may change the grouping of *Aspergillus* species.

3478 • A Medium for Rapid Identification and Enumeration of *Aspergillus flavus* and Related Organisms

R. J. Bothast and D. I. Fennell  
Mycologia 66(2): 365-369. March-April 1974

A new "*Aspergillus* Differential" medium (ADM) is described for enumerating *Aspergillus flavus* and closely related species. These fungi, whose presence on stored grains indicates possible aflatoxin contamination, produce a persistent bright yellow-orange pigment under nonsporulating colonies.

## 3479 • Processing Soybeans into Protein Products

W. J. Wolf

A.O.M. Bulletin pp. 3403-3408. October 1973

Supply, composition and structure of soybeans are reviewed briefly followed by a description of processes for converting soybeans into the three major protein product types presently available--flours and grits, concentrates, and isolates.

## 3480 • Laser Raman Spectra of Long Chain Sulfur Derivatives

George E. McManis and Lyle E. Gast

J. Amer. Oil Chem. Soc. 51(5): 198-199. May 1974

Laser Raman spectroscopy is proving to be an important complement to infrared absorption spectroscopy in the analysis of derivatives of fatty acids and esters containing sulfur in their structure. Selected esters are being evaluated as extreme pressure lubricants, and information on the nature of the sulfur linkages in these derivatives should be useful in preparing products with satisfactory performance characteristics. The techniques of laser-excited Raman spectroscopy have been applied to elucidate the molecular structure of a series of mercaptans, sulfides, and disulfides, as well as sulfur-containing derivatives of long-chain fatty acids and esters.

## 3481 • Chromatographic Separation and Identification of Nylon-9 Intermediates and Coproducts Derived from Soybean Oil

W. L. Kohlhasse, W. E. Neff, R. A. Awl, E. H. Pryde, and J. C. Cowan

J. Amer. Oil Chem. Soc. 51(5): 204-209. May 1974

9-Aminononanoic acid, 9-aminononanamide, and related compounds derived from soybean oil by reactions, including reductive ozonolysis and reductive amination, were separated on an analytical scale either by gas liquid chromatography of trifluoroacetylated or trimethylsilylated derivatives or by thin layer chromatography and on a preparative scale by ion-exchange chromatography. Comparative analyses also were carried out with certain homologous  $\omega$ -amino acids and amines.

## 3482 • Ethylene and Dimethyl Acetals from Hydroformylated Linseed, Soybean, and Safflower Methyl Esters as Plasticizers for Polyvinyl Chloride

R. A. Awl, E. N. Frankel, E. H. Pryde, and G. R. Riser<sup>1</sup>(<sup>1</sup>Eastern Regional Research Laboratory, Philadelphia, Pa.)

J. Amer. Oil Chem. Soc. 51(5): 224-228. May 1974



Dimethyl and ethylene acetals of polyformylated unsaturated fatty esters were prepared, characterized, and evaluated as polyvinyl chloride plasticizers. Dimethyl acetals were prepared with trimethyl orthoformate as a water scavenger in the acid catalyzed acetalation reaction. With ethylene acetals, water was removed azeotropically. Although the acetals prepared were mixtures, molecular distillation gave diacetal esters of 80-90% purity and triacetal esters of 80-95% purity. The samples were characterized by gas liquid chromatography and by infrared and nuclear magnetic resonance spectra. Compared to di-2-ethylhexyl phthalate as a plasticizer for polyvinyl chloride, the triacetal esters (both dimethyl and ethylene acetals) gave less migration and at least equivalent volatility characteristics; the triacetals also gave equivalent compatibility and strength, but somewhat less desirable low temperature and heat stability properties. The diacetal esters also had good compatibility, equivalent strength, somewhat better low temperature, but less desirable migration and volatility properties.

3483 • Acid Protease Production by Fungi Used in Soybean Food Fermentation

Hwa L. Wang, Janet B. Vespa, and C. W. Hesseltine  
Appl. Microbiol. 27(5): 906-911. May 1974

Growth conditions for maximum protease production by *Rhizopus oligosporus*, *Mucor dispersus*, and *Actinomucor elegans*, used in Oriental food fermentations, were investigated. Enzyme yields by all three fungi were higher in solid substrate fermentations than in submerged culture. The level of moisture in solid substrate must be at about 50 to 60%. Very little growth of these fungi was noted when the moisture of substrate was below 35%, whereas many fungi including most storage fungi generally grow well on solid substrate with that level of moisture. Among the three substrates tested--wheat bran, wheat, and soybean--wheat bran was the most satisfactory one for enzyme production. The optimal conditions for maximum enzyme production of the three fungi grown on wheat bran were: *R. oligosporus*, 50% moisture at 25° C. for 3 to 4 days; *M. dispersus*, 50 to 63% moisture at 25° C. for 3 to 4 days; *A. elegans*, 50 to 63% moisture at 20° C. for 3 days. Because these fungi are fast growing and require high moisture for growth and for enzyme synthesis, the danger of contamination by toxin-producing fungi would be minimal.

3484\* • Hydrolysis of Linoleate Geometric Isomers by *Geotrichum candidum* Lipase

Robert G. Jensen,<sup>1</sup> Dennis T. Gordon,<sup>1</sup> and C. R. Scholfield  
(<sup>1</sup>University of Connecticut, Storrs)  
Lipids 8(5): 323-325. September-October 1973

Lipase (EC 3.1.1.3) from the microorganism *Geotrichum candidum* preferentially hydrolyzes *cis*-9 18:1 and *cis,cis*-9,12 18:2 from triacylglycerols largely

ignoring all other positional isomers of *cis* 18:1 as well as *trans*-9 18:1. To obtain additional information about the specificity of the enzyme, two triacylglycerols were prepared as substrates. The lipase hydrolyzed 85% *cis,cis*-9,12 18:2 and 15% *trans,trans*-9,12 18:2 from the triacylglycerol containing about 50% of each acid. From the triacylglycerol containing 46.3% *cis,trans*-9,12 18:2 and 53.7% *trans,cis*-9,12 18:2, 44.8 and 55.2% of the two acids were hydrolyzed. Therefore, the enzyme discriminated against the *trans,trans* isomers but did not differentiate between the two *cis,trans* isomers.

- 3485\* • Ion-Exchange Chromatography of a Toxic Fescue Extract Assayed by Intraperitoneal Infusion into Cattle  
M. Williams,<sup>1</sup> S. R. Shaffer,<sup>1</sup> G. B. Garner,<sup>1</sup> S. Yates, and H. L. Tookey  
(<sup>1</sup>University of Missouri, Columbia)  
Proc. Fescue Toxicity Conf., Lexington, Kentucky, May 31-June 1, 1973, pp. 81-90. 1974

Chemical fractionation of an ethanolic extract of toxic fescue hay by ion-exchange chromatography, with subsequent intraperitoneal infusion of the fractions into cattle, has demonstrated that the principle(s) responsible for fescue toxicity is present in the anion fraction. Visual diagnosis of the syndrome in the affected cattle was compatible with that observed in histological sections of the rear coronary bands and tail tips.

- 3486\* • Assay of Toxic Fescue  
S. G. Yates, M. D. Grove, and H. L. Tookey  
Proc. Fescue Toxicity Conf., Lexington, Kentucky, May 31-June 1, 1973, pp. 108-113. 1974

The clinical signs of fescue foot were produced in cattle by feeding tall fescue hay from a toxic source. Extracts of the toxic hay were prepared and assayed in cattle. The toxic factor was extracted from toxic hay into 80% ethanol and remained in the aqueous phase when lipids, alkaloids, and other compounds were removed from a concentrated extract. Small animals were not satisfactory for assay. The scarcity of toxic tall fescue compared to a need for large quantities of toxic hay required suspension of the extraction-fractionation-cattle assay approach until further research showed that a steady supply of toxic tall fescue could be produced and that i.p. infusion of toxic fractions into cattle would reduce the quantity of toxic hay required. Fungi found on toxic tall fescue were also investigated as a cause of fescue foot.



## 3487\* • Relation of Mycotoxins to Fescue Toxicity

M. D. Grove, H. L. Tookey, and S. G. Yates

Proc. Fescue Toxicity Conf., Lexington, Kentucky, May 31-June 1, 1973, pp. 124-130. 1974

According to published results of testing two mycotoxins from *Fusarium tricoinctum* in cattle, T-2 toxin injected intramuscularly at 0.1 mg./kg. for 65 days caused death from internal hemorrhaging similar to that found in cattle after ingestion of moldy corn. 4-Acetamido-4-hydroxy-2-butenic acid  $\gamma$ -lactone injected at 3.8 mg./kg. for 90 days produced dry gangrene in the distal portion of the tail. Chronic oral administration of the lactone at 16-22 mg./kg./day caused tail edema or necrosis, loss of weight, nephritis, rumenitis, and hepatitis. Similar, but less severe, lesions were found following dosage with 2.2 g./kg./day of *F. tricoinctum* cultures grown on fescue hay. Lameness and gangrene of the feet, two characteristic signs of the fescue foot syndrome, were not observed.

## 3488\* • Potato Chips from Unpeeled Potatoes

Roy Shaw,<sup>1</sup> C. D. Evans, Shirley Munson,<sup>2</sup> G. R. List, and K. Warner  
(<sup>1</sup>Red River Valley Potato Research Center, East Grand Forks, Minn.;  
<sup>2</sup>University of Minnesota, St. Paul)

Amer. Potato J. 50(12): 424-430. December 1973

Two pilot-plant runs of 23 hours each were made with peeled and unpeeled potatoes. Samples of chips were taken at intervals and subjected to sensory evaluation after accelerated storage at 60° C. and room temperature storage for 1, 3, 6, and 9 weeks. Samples of oil were taken at intervals and analyzed for color, free fatty acids, peroxide values, and copper. Chips from peeled and unpeeled potatoes were similar in all evaluations. There was a significant increase in yield of chips from unpeeled potatoes.

3489 • Determination of Trypsin Inhibitor Activity of Soy Products:  
A Collaborative Analysis of an Improved ProcedureM. L. Kakade,<sup>1</sup> J. J. Rackis, J. E. McGhee, and G. Puski<sup>2</sup>(<sup>1</sup>Land O'Lakes, Inc., Minneapolis, Minn.; <sup>2</sup>Central Soya Co.,  
Inc., Chicago, Ill.)

Cereal Chem. 51(3): 376-382. May-June 1974

A more accurate and reproducible procedure is described for measurement of trypsin inhibitor activity of soybean products than the method developed by Kakade in 1969 for measuring antitryptic activity in raw soybeans. Because the modified procedure is particularly suitable in determining trypsin inhibitor activity of heat-processed samples, it is recommended for use in evaluating the heat destruction of trypsin inhibitors in soybean samples.

- 3490 • Flavors Derived from Linoleic and Linolenic Acid Hydroperoxides  
J. E. Kalbrener, K. Warner, and A. C. Eldridge  
Cereal Chem. 51(3): 406-416. May-June 1974

Hydroperoxides of linoleic and linolenic acid were prepared using soybean lipoxygenase. After purification by silicic acid chromatography, flavors of the hydroperoxides in water were characterized by a trained taste panel. Linoleic acid hydroperoxide (50 p.p.m.) was described as predominantly grassy/beany, musty/stale, and bitter. Linolenic acid hydroperoxide (10 p.p.m.) was described with a variety of terms with the most predominant description being grassy/beany, followed by bitter and astringent. Each purified hydroperoxide was stored as a 5 to 6% solution in ethanol at -6° C. During the 10-day storage, no significant changes occurred in flavor intensity or description of the hydroperoxides. Dilute solutions of linoleic (~50 p.p.m.) and linolenic (~30 p.p.m.) acids in 0.05N borate buffer, pH 9.0, treated with lipoxygenase were tasted directly. Flavor responses were similar to the responses of the purified hydroperoxides.

- 3491 • Starch-Filled Polyvinyl Chloride Plastics--Preparation and Evaluation  
Richard P. Westhoff, Felix H. Otey, Charles L. Mehlretter, and Charles R. Russell  
Ind. Eng. Chem. Prod. Res. Develop. 13(2): 123-125. June 1974

Starch was uniformly mixed with polyvinyl chloride (PVC) to produce clear plastics containing up to 50% starch. Of the techniques evaluated, the most uniform and transparent specimens resulted when starch and PVC were mixed as a water dispersion followed by either coprecipitation of the resin-filler mixture or by evaporation of the water to produce a dry mixture of the two components. Physical properties of the plastics closely parallel those for plastics containing inorganic fillers, except for improved clarity. The plastics were readily attacked by a mixture of microorganisms commonly found in soil.

- 3492 • Isolation of Antitumor Alkaloids from *Cephalotaxus harringtonia*  
Richard G. Powell, S. Peter Rogovin, and Cecil R. Smith, Jr.  
Ind. Eng. Chem. Prod. Res. Develop. 13(2): 129-132. June 1974

Purified antitumor alkaloids (harringtonine, isoharringtonine, and homoharringtonine) from *Cephalotaxus harringtonia* have been isolated in the pilot plant. Major processing steps included extraction of the plant material with ethanol, isolation of a crude alkaloid fraction by chloroform extraction, preliminary separation of the crude alkaloids by 10-tube countercurrent distribution, concentration of the active alkaloids by column chromatography, and final



separation of the active alkaloids by 200-tube countercurrent distribution. From 455 kg. of plant material, about 330 g. of crude alkaloid was obtained which yielded 36 g. of three purified active cephalotaxine esters.

- 3493 • Inheritance of Hilar Layer Coloring in White Corn (*Zea mays* L.)  
M. S. Zuber,<sup>1</sup> M. J. Wolf, E. S. Hilderbrand,<sup>1</sup> and Irene Cull  
(<sup>1</sup>University of Missouri, Columbia)  
Crop Sci. 14(2): 199-200. March-April 1974

The inheritance of hilar layer coloring (also known as black layer) in maize (*Zea mays* L.) was studied using four white endosperm inbred line parents, their six possible F<sub>1</sub> and F<sub>2</sub> generation single crosses, and 12 first generation backcrosses and their reciprocals. The results showed that the inheritance of hilar layer coloring is complex in this set of material, but it should be possible to develop corn strains with less hilar layer coloring. However, because hilar coloring may be due to condensed phenolic compounds that may inhibit the passage of certain pathogenic fungi into the kernel, reducing the level of pigmentation might lower resistance to kernel-rotting fungi. Further studies are needed to determine if hilar layer pigmentation inhibits kernel-rotting fungi.

- 3494\* • A Simplified Continuous Viscometer for Non-Newtonian Fluids  
John L. Scheve,<sup>1</sup> William H. Abraham,<sup>2</sup> and Earl B. Lancaster  
(<sup>1</sup>E. I. DuPont de Nemours & Co., Inc., Victoria, Texas;  
<sup>2</sup>Iowa State University, Ames)  
Ind. Eng. Chem., Fundam. 13(2): 150-154. May 1974

A study was made to evaluate a simple pipeline viscometer capable of continuous measurement of true viscosity of non-Newtonian fluids. The prototype model consists of two pipes of slightly different diameters connected in series, with provision for measurement of axial pressure gradients and flow rate. Mathematical analysis establishes a fundamental relationship among the three measured quantities and the corresponding shear stresses and rate of strain at the fluid pipe-wall interfaces. The relationship was experimentally verified with glycerine, carboxymethyl cellulose solutions, and starch pastes as test fluids, since results agree with shear curves obtained by application of classical capillary analysis.

- 3495 • Poly- $\beta$ -Hydroxyalkanoate from Activated Sludge  
Lowell L. Wallen and William K. Rohwedder  
Environ. Sci. Technol. 8(6): 576-579. June 1974

A new compound has been isolated by chloroform extraction of activated sludge supplied by the Greater Peoria Sanitary District and from the waste

purification facility of an industrial grain-processing plant. The compound is a polyester with physical and chemical properties similar, but not identical, to those of poly- $\beta$ -hydroxybutyrate (PHB). The polyhydroxyalkanoate (PHA) is composed primarily of  $\beta$ -hydroxyvaleric and  $\beta$ -hydroxybutyric acids, along with lesser amounts of higher molecular weight components. It melts at 97-100° C., whereas PHB melts at 160-170° C. Because PHA is soluble in hot 95% ethanol, it can be separated from the alcohol-insoluble PHB. Gas chromatographic analysis of products obtained by hydrogenolysis and by saponification of PHA has given evidence for a mixture of C<sub>4</sub>, C<sub>5</sub> (major component), C<sub>6</sub>, and C<sub>7</sub> components. Structural studies show PHA to be a new microbial polymer present in activated sludge.

- 3496 • Glucosinolate Determination in Cruciferous Seeds and Meals by Measurement of Enzymatically Released Glucose  
Cecil H. VanEtten, Clara E. McGrew, and Melvin E. Daxenbichler  
J. Agr. Food Chem. 22(3): 483-487. May-June 1974

Hydrolysis of glucosinolates by thioglucoside glucohydrolase EC 3.2.3.1 (thioglucosidase) releases  $\beta$ -D-glucose. The glucose was measured colorimetrically after specific enzymatic oxidations with readily available reagents containing a glucose oxidase, peroxidase, and chromogen. By this procedure glucosinolates were determined successfully in seed extracts after interfering substances were removed with charcoal. Samples containing glucosinolates equivalent to 0.01 to 0.15 mg. of glucose were analyzed with either added or endogenous thioglucosidase. In the procedure involving addition of thioglucosidase, endogenous enzyme was first heat-inactivated and free glucose determined. This modification is particularly useful in assessing changes during seed storage and processing. Crambe seed analysis by the two methods agreed and were within 10% of results by an established independent method. Relative standard deviation by three tests was 3.3, 4.2, and 6.5%. Test paper impregnated with the enzymes and chromogen permitted screening of plant breeding samples for glucosinolate content.

- 3497 • Elastomers Encased in a Little Starch...Could Put Starch in Powdered Rubber Mart  
T. P. Abbott, C. James, W. M. Doane, and C. R. Russell  
Rubber World 169(6): 40-43. March 1974

These Department of Agriculture researchers have succeeded in producing powdered rubbers with cheap materials and an inexpensive process. The materials--starch, water, sodium hydroxide, and carbon disulfide, all costing several times less than any general purpose rubbers--are used to make a starch xanthate solution, which is added in small quantities to latex to produce a fine crumb or powder. The starch xanthate encasement is said not to affect either the properties or performance of the rubber, but provides



a powder that easily adapts to automatic weighing and handling systems and that requires substantially less power than conventional forms of rubber to prepare compounded stocks. The procedure has been thoroughly and successfully tested with emulsion polymerization systems, and is now undergoing tests with solution systems. The one engineering problem still to be resolved is drying. Pilot-scale trials with certain commercial drying systems have yielded the desired quality of product, but not the rates. This is not considered to be a major stumbling block, however, and already there is indication that producers of black masterbatches having fluidized bed driers might be able to produce powders even cheaper than they could slab or crumb rubber. And as to the chief additive in this technology, namely starch, the researchers say it is both cheap (now \$0.04-0.06/lb.) and plentiful--if all the carbon black used in the rubber industry today were replaced by starch, they say, it would not put a dent into the total starch market.

- 3498 • Micro-Organism Culture Collections: Acronyms and Abbreviations  
T. G. Pridham  
U.S. Dept. Agr., Agr. Res. Serv., ARS-NC-17, 41 pp. June 1974

This study and compilation was made as part of the investigations being conducted at the Northern Regional Research Laboratory on industrial utilization of cereal grains and oilseed crops. There now are many culture collections located throughout the world, some quite reliable, others less so. Information may be obtained on acronyms by perusing many different culture collection catalogues; but none provides a complete list. Accordingly, it is the purpose of this bulletin to provide the most complete listing to date.

- 3499 • Extracellular Microbial Polysaccharides: New Hydrocolloids of Interest to the Food Industry  
Allene Jeanes  
Food Technol. 28(5): 34-36, 38, 40. May 1974

The polysaccharide hydrocolloids used traditionally for manifold purposes in foods and food processes have originated from photosynthetic activity of plants, both land and aquatic. An additional newly developing source of polysaccolloids of demonstrated or apparent suitability for use in foods is based on the biosynthetic capabilities of nonpathogenic microorganisms. Research at the Northern Regional Research Laboratory has augmented awareness of the great numbers of microbial species, nonpathogenic to man, that produce polysaccharides both extracellularly and abundantly. This research not only has extended our knowledge of polysaccharide composition and structure, but also has established their unusual properties amenable to practical utility. Reviewed here are some of the basic research and the associated industrial developments on extracellular microbial polysaccharides as related to foods.

- 3500 • Unambiguous Syntheses of the 3,4-Di- and 3,4,6-Tri-Methyl Ethers of Methyl  $\alpha$ -D-Mannopyranoside  
 Fred R. Seymour  
 Carbohydr. Res. 34(1): 65-70. May 1974

The unambiguous syntheses of methyl 3,4,6-tri-*O*-methyl- $\alpha$ -D-mannopyranoside (6) and methyl 3,4-di-*O*-methyl- $\alpha$ -D-mannopyranoside (10) were performed by routes involving methyl 3-*O*-benzoyl-4,6-*O*-benzylidene- $\alpha$ -D-mannopyranoside (1) to form methyl 2-*O*-*p*-tolylsulfonyl D-mannopyranoside (4). Compound 4 directly led to 6, and via a 6-trityl derivative, to 10.

- 3501 • An Edible Defatted Germ Flour from a Commercial Dry-Milled Corn Fraction  
 C. W. Blessin, W. J. Garcia, W. L. Deatherage, and G. E. Inglett  
 Cereal Sci. Today 19(6): 224-225, 248. June 1974

At present defatted corn germ primarily is a component of animal feeds, but germ could serve as a source of flour for incorporation in food products. We developed a process for preparing an edible defatted flour from commercial dry-milled germ. The process, based on grinding and screening, reduces both black specks and fiber content. The finished flour contains approximately 25% protein, 24% starch, 11% ash, 2% fiber, and less than 0.5% fat. Yield and compositional data are included for other fractions separated during preparation of the flour.

- 3502 • Influence of *Opaque-2* and *Floury-2* Genes on Formation of Proteins in Particulates of Corn Endosperm  
 D. D. Christianson, U. Khoo, H. C. Nielsen, and J. S. Wall  
 Plant Physiol. 53(6): 851-855. June 1974

Protein-rich subcellular particulates were isolated by zonal centrifugation from homogenates of endosperms of normal, *opaque-2*, and *floury-2* mutant corn strains at varying stages of maturity. The differences in amounts and composition of the storage and structural protein in the particulates were evaluated to establish a basis for the biosynthesis of more lysine in the mutant corn strains. Increased biosynthesis of a lysine-rich glutelin occurs in place of zein-body formation in corn endosperm of high-lysine varieties. This glutelin is either incorporated into the matrix protein or synthesized at a lesser rate in the mature kernel.



3503\* • Oat Protein Concentrates from a Wet-Milling Process:  
Composition and Properties

Y. Victor Wu, James E. Cluskey, Joseph S. Wall, and  
George E. Inglett

1972 Oat Newsletter 23: 18. July 1973

Protein concentrates, starch, and residue fractions produced by a wet-milling process from ground oat groats with moderate- and high-protein contents were analyzed for amino acid composition, protein, starch, fat, fiber, ash, and various neutral carbohydrates. The concentrates, which have a bland taste, contain up to 75% protein (nitrogen X 6.25) with good lysine and adequate total sulfur amino acids. The concentrates are low in fiber, have around 4% ash and no starch, and contain up to 23% total carbohydrate. Fat content of protein concentrates from nondefatted groats is around 14%, whereas that from defatted groats is less than 2%. The starch fraction is essentially pure. The protein concentrates have good nitrogen solubility around pH 2.5 and above 8, good storage stability, reasonable hydration capacity, and emulsion stability. The groats with higher protein content gave a protein concentrate with better yield, higher protein content, and better total sulfur amino acids than a protein concentrate from moderately high-protein oats.

3504\* • Oat Protein Concentrates from a Wet-Milling Process:  
Preparation

James E. Cluskey, Y. Victor Wu, Joseph S. Wall, and  
George E. Inglett

1972 Oat Newsletter 23: 18. July 1973

A wet-milling process has been developed that produces a protein concentrate, starch, and residue fractions from ground oat groats having moderate- and high-protein contents. Different solvents and pH values were evaluated for their effectiveness in extracting oat protein. The optimum yield of protein was achieved in a dilute alkali solution at pH 9. Starch and protein were separated from bran by sieving the alkaline dispersion. After the fine suspension was centrifuged to separate pure starch, the protein solution was neutralized and freeze-dried. The concentrate had a maximum of 89% protein (nitrogen X 6.25) and up to 88% of the total protein in the starting material. This simple process for producing an oat protein concentrate may have commercial potential.

3505\* Protein Concentrates from Oat Groats and Flours by Air  
Classification

Y. Victor Wu and Arthur C. Stringfellow

1972 Oat Newsletter 23: 19. July 1973

Defatted oat groats, as well as derived first and second flours, from two varieties representing normal and high levels of protein content were finely ground and air-classified. Fractions were obtained with protein contents (nitrogen X 6.25) ranging from 4 to 88%. The exceptionally high-protein fraction recovered from oat groats and flours was not previously observed for wheat, rye, corn, sorghum, or triticale flours. This unique fraction accounted for a maximum of 5% by weight, corresponding to 15% of total protein in the starting material. The next fraction (around 27% by weight) had a maximum of 39% protein, corresponding to 43% of the total protein. First and second flours gave fractions with a wider range of protein content than did ground groats, and the high-protein variety gave better results than the normal-protein variety. Amino acid analysis of the fractions indicated good lysine levels and adequate total sulfur amino acids. Data suggest that air classification of oat flours and ground groats can produce protein concentrates which have good amino acid composition and which could be new food ingredients suitable for many uses.

- 3506\* • Crystal and Molecular Structure of Cephalotaxine *p*-Bromobenzoate  
S. K. Arora,<sup>1</sup> R. B. Bates,<sup>1</sup> R. A. Grady,<sup>1</sup> and R. G. Powell  
(<sup>1</sup>University of Arizona, Tucson)  
J. Org. Chem. 39(9): 1269-1271. May 1974

An X-ray study on the title compound verifies the constitution and relative configurations proposed for cephalotaxine and its esters, and shows for the first time the absolute configuration (5*S*). The conformation of the cephalotaxine portion of the molecule closely resembles that of the racemic methiodide, and is probably favored as well in the natural antileukemic cephalotaxine esters.

- 3507\* • Regulation of Secondary Biosynthesis in *Gibberella fujikuroi*  
J. D. Bu'Lock,<sup>1</sup> R. W. Detroy, Z. Hostalek,<sup>1</sup> and  
Abdul Munim-Al-Shakarchi<sup>1</sup>  
(<sup>1</sup>The University, Manchester, England)  
Trans. Brit. Mycol. Soc. 62(2): 377-389. April 1973

Comparisons between submerged batch and chemostat fermentations of *Gibberella fujikuroi* show that major features of batch culture development relate directly to the degree of limiting substrate depletion and the corresponding growth rate. So-called secondary biosynthetic processes (mycelial carbohydrate accumulation, bikaverin and gibberellin synthesis) are controlled by differential sensitivities to a common mechanism of growth-linked suppression.



- 3508 • Antibiotic Produced by *Fusarium equiseti* NRRL 5537  
 H. R. Burmeister, G. A. Bennett, R. F. Vesonder, and  
 C. W. Hesseltine  
 Antimicrob. Ag. Chemother. 5(6): 634-639. June 1973

*Fusarium equiseti* NRRL 5537 grown on an autoclaved white corn-grit medium for 3 to 4 weeks at room temperature produced a substance in excess of 5 g./kg. of substrate that inhibited some gram-positive bacteria including mycobacteria. Most *Bacillus subtilis*, *Mycobacterium phlei*, and *Staphylococcus aureus* strains were inhibited when 1 µg. of the antibiotic per ml. was incorporated into the culture medium. Except for *Neisseria perflava*, gram-negative bacteria, yeasts, and molds were not inhibited by 128 µg./ml. The antibiotic was recovered as a white powder, had a melting point of 65 to 66° C., and had an intraperitoneal mean lethal dose in white mice of 63 mg./kg. of body weight. In thin-layer chromatographic analysis the compound appeared as a single spot in two different solvent systems. Mass spectrometry determined that the molecular weight of the antibiotic was 373 with a molecular formula of  $C_{22}H_{31}NO_4$ . Chemical microanalysis was in accord with the formula.

- 3509 • Molecular Weights by Computer from Gel Permeation Data on Punched Tape  
 Charles L. Swanson, Joseph O. Ernst, and L. A. Gugliemelli  
 J. Appl. Polym. Sci. 18(5): 1549-1556. May 1974

A Fortran IV program has been written that reduces digitized data from gel permeation chromatography to number and weight average molecular weights. This computer program is suitable for routine calculations whenever corrections are unnecessary for axial diffusion and branching effects.

- 3510 • Cellulase Production by *Trichoderma viride* on Feedlot Waste  
 H. L. Griffin, J. H. Sloneker, and G. E. Inglett  
 Appl. Microbiol. 27(6): 1061-1066. June 1974

Feedlot waste contains essentially all the necessary nutrients for batch fermentation with the fungus *Trichoderma viride*. The organism utilizes two-thirds of the carbohydrate in feedlot waste while elaborating cellulase in quantities comparable to commercial preparations. Essentially odor-free, the fermented waste contains all of the original nitrogen but has 24% less organic matter.

- 3511 • Aflatoxin-Producing Strains of *Aspergillus flavus* Detected by Fluorescence of Agar Medium Under Ultraviolet Light  
S. Hara, D. I. Fennell, and C. W. Hesseltine  
Appl. Microbiol. 27(6): 1118-1123. June 1974

The fluorescence method of detecting aflatoxin-producing strains of *Aspergillus flavus* and related species utilizes the ultraviolet-induced fluorescence of aflatoxin produced in a modified Czapek's solution agar containing corn steep liquor,  $\text{HgCl}_2$ , and  $(\text{NH}_4)\text{H}_2\text{PO}_4$  instead of  $\text{NaNO}_3$ . The presence of aflatoxin is confirmed by thin-layer chromatography of  $\text{CHCl}_3$  extracts of the fluorescing agar.

- 3512\* • Linseed Oil Studies at the Northern Regional Research Laboratory  
L. E. Gast  
Proc. 43rd Annu. Flax Institute of the United States,  
Dec. 7, 1973, Fargo, North Dakota, pp. 15-18. [1974]

Several areas of recent research at the Northern Laboratory include the synthesis, properties, and outdoor film exposure studies on polyesteramides and their urethane derivatives; conjugation of soybean and linseed oils with dimethyl sodium and potassium catalysts; and field and laboratory tests on new linseed emulsion formulations to cure and protect concrete. Comparisons were made between the performance of the experimental products and commercial products now in use.

- 3513 • Starch Xanthide Styrene-Butadiene Rubbers. Effect of Prolonged Water Immersion  
R. A. Buchanan  
Staerke 26(5): 165-172. May 1974

Both conventionally reinforced and starch xanthide-reinforced styrene-butadiene (SBR) rubbers swell continuously during water immersion without reaching equilibrium and eventually mechanical breakdown occurs. During 90 days of water immersion, starch xanthide-reinforced SBR swells more than conventionally reinforced SBR, but much less than would be calculated from the volume fraction of starch xanthide and its swelling ratio as measured separate from rubber. Swelling rate of vulcanized starch xanthide-SBR rubber specimens depends on their shape and is negligible for specimens with low enough surface to volume ratios. Standard tensile test specimens have low cross sections in the break area and provide a sensitive measure for the deleterious effect of prolonged water immersion. The effects after 90 days in water on both swelling and tensile properties of starch xanthide-SBR are fully reversible by drying test specimens. Starch xanthide-SBR



masterbatch can be compounded either with reactive crosslinking and coupling agents or with low-cost extenders and fillers to reduce greatly the effect of prolonged water immersion.

3514 • Hydrogenation of Soybean Oil with Copper-Chromium Catalyst:  
Preliminary Plant-Scale Observations

G. R. List, C. D. Evans, R. E. Beal, L. T. Black, K. J. Moulton,  
and J. C. Cowan

J. Amer. Oil Chem. Soc. 51(6): 239-243. June 1974

Four commercial hydrogenations were carried out on 20,000-pound batches of soybean oil with 0.25, 0.5, and 1% fresh copper-chromite catalyst and 1% used catalyst. Hydrogenations proceeded smoothly at catalyst levels of 0.5 and 1%, but the reaction was slow at a 0.25% concentration. Kinetic, selectivity ( $K \frac{L_n}{L_o}$ ), and fatty acid compositional data were acquired during several of the hydrogenation runs. Nickel contamination, confirmed by analysis of the 1% used copper catalyst, lowered selectivity.

Copper content of the oil rose during hydrogenation, but normal processing steps (particularly bleaching and winterization) removed it to below levels (0.01-0.02 p.p.m.) detectable by direct atomic absorption spectroscopy. Both copper and chromium remaining in the oil after processing were concentrated by winterization in the stearine fraction.

Organoleptic, oxidative, and room odor tests showed that oils of good stability can be produced on a commercial scale by copper hydrogenation and winterization. Information was gained regarding problems involved in the plant use of copper-chromite catalyst for hydrogenating soybean oil for edible purposes.

3515 • Quantitative Gas Chromatographic Analysis of Lipids: Comparison of Gas Density Balance and Flame Ionization Detector

Alan C. Lanser, A. E. Johnston, and H. J. Dutton

J. Amer. Oil Chem. Soc. 51(6): 274-277. June 1974

The quantitative deficiency of the flame ionization detector (FID), as well as of other detectors, has been widely recognized, and empirical correction factors have been required. By contrast, the gas density balance (GDB), the forgotten "ideal detector," should not require calibration.

A GDB, now available in a commercial chromatograph, and an FID were compared for quantitative analyses of lipids. Weight percents of known methyl ester mixtures were determined, as well as mole percents of

aldehyde and aldehyde ester fragments from certain ozonized octadecenoate isomers. Percentages were calculated from area response without correction factors for the GDB and with correction factors, based on the number of ionizable carbon atoms, for the FID. Accuracy, as measured by percentage deviation from either known or theoretical values, was better for GDB data than for FID data.

3516 • Ethylene Adduct of Conjugated Octadecadienoic Acids: III.  
Aromatization of C<sub>20</sub> Cyclohexene Methyl Esters

E. W. Bell

J. Amer. Oil Chem. Soc. 51(6): 284-285. June 1974

A procedure is described for the catalytic aromatization of the ethylene adduct of conjugated isomers of methyl octadecadienoate. When the C<sub>20</sub> cyclohexene fatty methyl esters were heated at 290-300° C. with palladium and 1-octadecene as hydrogen acceptor, C<sub>20</sub> aromatic cyclic esters were obtained in 90-95% yield.

3517 • 6-Deoxy-1,2-*O*-isopropylidene-3-*O*-methyl-6-thio- $\alpha$ -D-glucofuranose  
5,6-Dithiocarbonate: A Versatile Intermediate

Baruch S. Shasha and William M. Doane

Carbohydr. Res. 34(2): 370-375. June 1974

According to conditions, a monodeoxy, a dideoxy, an olefin, an episulfide, and a piperidine derivative were obtained using 6-deoxy-1,2-*O*-isopropylidene-6-thio- $\alpha$ -D-glucofuranose 5,6-dithiocarbonate as a starting compound. The same starting compound initiated the polymerization of acrylamide.

3518\* • Removal of Heavy Metals from Wastewater with Starch Xanthate

R. E. Wing

Proc. Symp. "Traces of Heavy Metals in Water. Removal Processes and Monitoring," held at Princeton University, New Jersey, November 15-16, 1973, pp. 257-273. [1974]

A starch xanthate-poly(vinylbenzyltrimethylammonium chloride) complex effectively removes many heavy metal ions from water. Cadmium(II), chromium(III), copper(II), iron(III), lead(II), nickel(II), and silver(I) ions can be reduced to residual levels below stringent State of Illinois discharge limits. Considerable amounts of iron(II), manganese(II), and zinc(II) are removed, but residual levels for these three exceed the Illinois effluent limits. Mercury(II) is almost completely removed, but still its residual level (3.8  $\mu$ g./l.) remains above the accepted Illinois limit



(0.5  $\mu\text{g./l.}$ ). The solubility product constant of the metal ion xanthate is related to the completeness of removal. Metals that have  $K_{sp}$ 's with ethyl xanthate below  $10^{-12}$  are almost completely removed. The method is also effective on mixtures of metals and on industrial effluents containing certain metals.

- 3519\* • Studies on the Mycological Characters of Aflatoxin-Producing Strains Belonging to the *Aspergillus flavus* Group. Part 1. A New Medium and Method for Detecting Aflatoxin-Producing Abilities of Strains [In Japanese. English summary]  
Shodo Hara,<sup>1</sup> Hideya Murakami,<sup>1</sup> Seinosuke Sugama,<sup>1</sup>  
D. I. Fennell, and C. W. Hesseltine  
(<sup>1</sup>National Research Institute of Brewing, Tokyo, Japan)  
Rep. Res. Inst. Brew. No. 145: 1-7. November 1973

A new medium and method for detecting aflatoxin-producing strains of *Aspergillus flavus* were developed. Aflatoxin, which was produced in plate cultures of aflatoxin-producing strains, diffused into the agar medium surrounding the colonies and gave a blue fluorescence under ultra-violet light. The modified Czapek's agar medium containing corn steep liquor (0.05%),  $\text{HgCl}_2$  ( $5 \times 10^{-4}$  M) and  $(\text{NH}_4)\text{H}_2\text{PO}_4$  (1.0%) instead of  $\text{NaNO}_3$ , was adopted for the cultivation to investigate the blue fluorescence resulting from aflatoxin production. A few aflatoxin-negative strains also produced a weak blue fluorescence in the agar. Therefore, extraction of the blue fluorescent substances by chloroform and identification of aflatoxin by thin-layer chromatography were required for confirmation of aflatoxin-producing abilities.

- 3520\* • Studies on the Mycological Characters of Aflatoxin-Producing Strains Belonging to the *Aspergillus flavus* Group. Part 2. Isolation of Aflatoxin-Producing Strains from Corn Field in U.S.A. [In Japanese. English summary]  
Shodo Hara,<sup>1</sup> D. I. Fennell, and C. W. Hesseltine  
(<sup>1</sup>National Research Institute of Brewing, Tokyo, Japan)  
Rep. Res. Inst. Brew. No. 145: 8-12. November 1973

About 330 strains belonging to *Aspergillus flavus* group were isolated from insects (corn, earworm, and corn borer), corn husks, and corn kernels by field survey for aflatoxin. About 50% of all strains of *Aspergillus flavus* link isolated produced aflatoxin  $B_1$  and  $B_2$ . Only one strain of *Aspergillus toxicarius* Murakami was encountered, which produced aflatoxins  $B_1$ ,  $B_2$ ,  $G_1$ , and  $G_2$ .

## 3521\* • Mucorales

[C. W. Hesseltine]

In "Mycology Guidebook," ed. Russell B. Stevens, chap. 7,  
pp. 92-99; chap. 20, pp. 372-373; Appendices, pp. 617-620.  
Seattle, Wash. 1974

The paper explains where one can find members of the Mucorales, how they are isolated and grown, how to study them, and how one can keep cultures for class use.

## 3522\* • Sexual Agglutination in Yeasts

[L. J. Wickerham]

In "Mycology Guidebook," ed. Russell B. Stevens, chap. 23,  
pp. 488-490. Seattle, Wash. 1974

Some species of protozoa, algae, and fungi have complementary substances on their cell surfaces that cause opposite sexes to adhere when they come in contact. Zygote formation is stimulated. The process is called sexual agglutination.

## 3523\* • Recovery of Animal Feed from Cattle Manure

R. W. Jones, J. H. Sloneker, and G. E. Inglett

Proc. 18th meeting of Institute of Environmental Sciences,  
New York, May 1-4, 1972, pp. 267-269. 1972

Manure from a commercial beef feedlot was fractionated to produce a high-protein animal feed. Manure was slurried in water, screened, and either filtered or centrifuged. The feed fraction (centrifuge or filter cake) contained 40% of the total weight of the manure and 70% of the total nitrogen. It contained about 35% protein (nitrogen X 6.25) and had an amino acid composition superior to cereal grains and comparable to soybean meal.

## 3524\* • Mycotoxins

Alex Ciegler

In "Handbook of Microbiology, Vol. III. Microbial Products,"  
eds. Allen I. Laskin and Hubert A. Lechevalier, pp. 525-576.  
Cleveland, Ohio. 1973

Mycotoxins can be produced by a variety of fungi on food and feedstuffs that on consumption cause disease in both man and animals; symptoms can be either acute or chronic. Although acute symptoms are more dramatic, chronic effects



may be more important in that they are insidious, difficult to detect, and can unknowingly cause considerable economic losses in livestock as a result of reduced feed efficiency and weight gains. Symptoms in mycotoxicoses tend to be nonspecific, hence difficult to diagnose. Many mycotoxins are hepatotoxins, but other organs of the body can be and often are involved.

The problem is worldwide, not confined to any geographic area, and is extremely complex since mycotoxins can be produced on grains in the field, during harvest and processing, and during storage of any given food or feed. The tendency of these toxins to occur in comparatively low concentrations complicates detection and analyses; the problem may be further exacerbated by the potential occurrence of mixed toxins and of toxins bound to the substrate in which they may be produced, which render them difficult to detect.

#### 3525\* • Soy Technology Draws 1100 in World Conference

W. J. Wolf

Food Eng. 46(2): 29-32. February 1974

A brief summary of the World Soy Protein Conference held in Munich, Germany, November 11-14, 1973.

#### 3526\* • New Protein Products from Oats and Corn Germ

G. E. Inglett

Proc. 15th Annu. Symp., "Recent Developments in Cereal Science," Central States Section, Amer. Ass. Cereal Chem., St. Louis, Mo., Feb. 15-16, 1974

New protein products have been prepared from oats and dry-milled corn germ for human food applications. Oat concentrates with protein contents ranging from 59-75% were produced from a wet-milling process developed at the Northern Laboratory. Air classification of oat flours gave a unique fraction containing 83-88% protein. Defatted corn germ flour was prepared from "purified" dry-milled germ by flaking, extracting with hexane, and grinding. A corn protein isolate was made by a mild alkali extraction of defatted germ, isoelectric precipitation of the protein, pH adjustment of the protein to 7.0, and then drying to give a product with 75% protein (nitrogen X 5.4).

## 3527\* • Milky Disease

Grant St. Julian and Lee A. Bulla, Jr.

In "Current Topics in Comparative Pathobiology," ed. Thomas C. Cheng, vol. 2, pp. 57-87. New York. 1973

The term milky disease refers to the milky appearance of the hemolymph (of various scarabaeid beetles) that is heavily laden with spores of *Bacillus popilliae* or *B. lentimorbus*. The bacterial spores, when ingested by beetle larvae, germinate and outgrow in the digestive tract. The resulting vegetative cells invade the hemolymph where they proliferate and ultimately form billions of spores before the insect host dies. The spores permit the pathogens to survive for long periods in the soil and are the means of further disease transmission. The Japanese beetle was the first insect found in the United States with milky disease. Consequently, most of the research on the disease involves this beetle. The Japanese beetle feeds on more than 257 different plants and annually destroys field crops, fruits, and ornamentals worth millions of dollars.

Some of the research involved in development of *B. popilliae* and *B. lentimorbus* as effective microbial insecticides for the beetle is summarized. Aspects of both laboratory and field experiments are given, as well as a brief history of the early work from discovery of the disease (1926) to field application of the bacteria (1940). Included are recent research advances concentrating on hemolymph constituents, oxygen uptake, and carbohydrate metabolism in both healthy and diseased larvae.

## 3528\* • Highly Absorbent Starch-Based Polymer

M. Ollidene Weaver, George F. Fanta, and William M. Doane  
Proc. Tech. Symp. Nonwoven Product Technol. Int. Nonwovens  
and Disposables Ass., Washington, D.C., March 5-6, 1974,  
pp. 169-177. 1974

The solid water-insoluble sorbent that swells in water is a base-hydrolyzed starch-polyacrylonitrile graft copolymer in which the nitrile functionality has been converted to a mixture of carboxamide and alkali metal carboxylate. After drying to a film in the carboxylate form, such an absorber is capable of imbibing about 700 times its own weight of deionized water and 55 times its own weight of an electrolyte solution simulating urine. The swollen absorbent retains 65-75% of the absorbed fluid under centrifugation (45 X g.). The polymer can be used either as a film coating on a substrate or as a particulate solid held in place mechanically. A preliminary estimate of the cost to make the polymer, including materials, is of the order of 21-25 cents per pound.



- 3529 • Xanthan Gum in Protein-Fortified Starch Bread  
D. D. Christianson, H. W. Gardner, K. Warner, B. K. Boundy,  
and G. E. Inglett  
Food Technol. 28(6): 23-26, 28-29. June 1974

Xanthan, a microbial polysaccharide gum, serves as a cohesive binder for the development of gas cell structure and texture in breads made from wheat and dent corn starches. In this hydrophilic system, starch baked goods can be fortified with 15-20% protein without significant changes in texture and volume. Loaf volume, texture, and crust compare well with commercial wheat breads. Crumb firming rates, upon storage, are similar to those observed with regular commercial breads.

No differences could be detected by taste panel evaluation in mouthfeel between starch breads and wheat bread. However, taste was scored significantly lower because of the lack of conventional wheat bread flavor.

## REPUBLICATIONS

- 2972 • Vegetable Proteins in the World Food Supply  
 R. J. Dimler  
*In "Current Topics in Food and Nutrition--1970," Proc.*  
*Workshop, University of Iowa, Iowa City, June 15-July 2,*  
*1970, eds. E. M. Osman and M. O. Osborn, pp. 70-90. [1973]*

This paper was also presented at the East Africa Seminar on Production, Utilization, and Marketing of Soybeans, Kampala, Uganda, in February 1971, and published in the Proceedings, pp. 32-43.

- 3124 • Fermented Soybean Foods  
 C. W. Hesseltine and H. L. Wang  
*In "Current Topics in Food and Nutrition--1970," Proc.*  
*Workshop, University of Iowa, Iowa City, June 15-July 2,*  
*1970, eds. E. M. Osman and M. O. Osborn, pp. 136-148. [1973]*

This paper was also presented at the 3rd International Conference on Global Impacts of Applied Microbiology, Bombay, India, December 7-12, 1969, and was published in Proceedings, pp. 403-420, in 1971.

- 3361 • Sources and Management of Micro-Organisms for the  
 Development of a Fermentation Industry  
 C. W. Hesseltine and W. C. Haynes  
 U.S. Dept. Agr., Agr. Handb. No. 440, 38 pp. March 1974

This review originally was published, under the same title, in *Progress in Industrial Microbiology* 12: 1-46 (1973).

## UNOFFICIAL PUBLICATIONS

Listing of publications and patents of the Northern Regional Research Laboratory would not be complete without including some unofficial publications. These are writings by members of the Northern Laboratory staff, and, although written from previously published official material, are of a public service value from the standpoint of review and updating of the literature. Reprints are not available at the Northern Regional Research Laboratory for distribution.

Propolis--Its Composition and Uses  
 Lloyd A. Lindenfelser  
 Beeline 3(4): 2-3. April 1974



# CONTRACT AND GRANT RESEARCH PUBLICATIONS

[Report of research work done by an outside agency under contract with U.S. Department of Agriculture and supervised by the Northern Regional Research Laboratory.]

- 262-C\* • Absorption of Iodine into Starch Granules in Aqueous Suspension

Y. Y. Lee and George T. Tsao  
Iowa State University, Ames  
Staerke 25(5): 166-168. May 1973

[Report of research done by an outside agency under a grant from the U.S. Department of Agriculture and supervised by the Northern Regional Research Laboratory.]

- 138-G\* • The V Amylose-H<sub>2</sub>O System: Structural Changes Resulting from Hydration

Bert Zaslow,<sup>1</sup> Vincent Gerard Murphy,<sup>2</sup> and Alfred Dexter French<sup>1,2</sup>

(<sup>1</sup>Arizona State University, Tempe; <sup>2</sup>Southern Regional Research Center, New Orleans, Louisiana)

Biopolymers 13(4): 779-790. April 1974

- 139-G\* • Separation of Factors Responsible for Lysozyme Catalysis

John A. Thoma

University of Arkansas, Fayetteville

J. Theor. Biol. 44(2): 305-317. April 1974

[Report of research work supported with funds provided by the U.S. Department of Agriculture under the authority of U.S. Public Law 480, 83rd Congress, and sponsored by the Northern Regional Research Laboratory.]

- 359-F • Insecticidal Activity of *Acorus calamus* on Stored Grain Insects  
D. C. Agarwal,<sup>1</sup> R. S. Deshpande,<sup>1</sup> and H. P. Tipnis<sup>2</sup>  
(<sup>1</sup>Department of Chemical Technology, Matunga, Bombay-19, India; <sup>2</sup>Bombay College of Pharmacy, Kalina, Bombay-29, India)  
Pesticides 7: 21. 1973
- 360-F • Purification and Properties of an Extracellular Polysaccharide Containing Amino Sugars Formed by *Bacillus cereus*  
D. Mirelman, R. Lotan, Yael Bernstein, H. M. Flowers, and N. Sharon  
Weizman Institute of Science, Rehovoth, Israel  
J. Gen. Microbiol. 77(1): 5-10. July 1973



January-June 1974

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## PATENTS

[These patents are assigned to the Secretary of Agriculture. Copies of patents may be purchased (50 cents each) from the Commissioner of Patents, U.S. Patent Office, Washington, D.C. 20231. Order by number, do not send stamps.]

### Molded Articles and Films

George G. Maher

U.S. Patent 3,787,220. January 22, 1974

A method is disclosed for the preparation of a variety of molded articles and films prepared from gels of crosslinked starch xanthate.

### Selective Hydroformylation of Unsaturated Fatty Compounds

Edwin N. Frankel

U.S. Patent 3,787,459. January 22, 1974

A process is described for converting unsaturated vegetable oil material without isomerization into high yields of formyl products which can be subsequently reduced to the corresponding hydroxymethyl products or oxidized to the corresponding carboxy products. The conversion is accomplished by reacting vegetable oil material with hydrogen and carbon monoxide in the presence of a highly selective catalyst system.

### Harringtonine and Isoharringtonine for Treating L1210 or P388 Leukemic Tumors in Mice

Richard G. Powell and Cecil R. Smith, Jr.

U.S. Patent 3,793,454. February 19, 1974

Alkaloids found to be chemotherapeutically active against leukemic strains L1210 and P388 in mice are produced from *Cephalotaxus harringtonia*. The

process includes extraction of plant parts with a polar solvent, partitioning the plant extracts between nonpolar and acidic aqueous solvents, making the aqueous portion basic, and removing the crude alkaloids from the basic aqueous solution. The crude alkaloids are purified and used in the treatment of mice implanted with leukemic strains L1210 and P388.

#### Process for Making Starch Triacetates

Arthur M. Mark and Charles L. Mehltretter  
U.S. Patent 3,795,670. March 5, 1974

An improved process for the esterification of starches such as high-amylose starches and amylose under conditions of minimum depolymerization of the polysaccharide to obtain high-molecular-weight starch triacetates soluble in organic solvents for fiber and film manufacture is described.

#### Epoxypropyl Starch

Robert E. Wing and William M. Doane  
U.S. Patent 3,795,671. March 5, 1974

A process is described for preparing novel epoxypropyl starch compounds from starches and derivatives. At epoxypropyl D.S. levels of up to 0.09 the compounds are water-soluble and increase both wet and dry strength of paper at a 1% level of addition.

#### Preparation of Carboxy Alkanoic Acids and Esters

Arthur W. Schwab  
U.S. Patent 3,804,895. April 16, 1974

A method is disclosed for preparing carboxy alkanoic acids and esters by catalytic conversion of hydroformylated fatty acids and esters. Yields as high as 95% were obtained with a minimum of side reactions.

### Method of Preparing Starch Graft Polymers

George F. Fanta and Robert C. Burr

U.S. Patent 3,809,664. May 7, 1974

A wide variety of starch graft polymers are prepared from water-soluble ethylenically unsaturated monomers in admixture with selected amounts of starch and water by adding the admixture to a hot, water-immiscible solvent.

### Process for Obtaining Full-Fat Oilseed-Protein Beverages

Gus C. Mustakas

U.S. Patent 3,809,771. May 7, 1974

A full-fat oilseed beverage is prepared by suspending full-fat oilseed flour in water, inactivating the lipooxygenase, precipitating the lipid-protein, resuspending the precipitate in water at pH of about 9, heating and cooling the suspension, adjusting the pH to about 7 and clarifying.

### Method for Preparing a Liquid Iron-Fortifying Composition

George N. Bookwalter

U.S. Patent 3,809,773. May 7, 1974

A method for preparing highly stable, liquid, iron-fortifying compositions containing up to 1% by weight of ferrous or ferric ions. An aseptic and deaerated aqueous solution of an iron salt is prepared and blended with a high D.E. corn syrup. Food products such as baby formulas, bread, and fruit drinks may be iron-supplemented with the iron-fortifying compositions.



## LICENSING OF PATENTS

Many inventions and discoveries of the Northern Laboratory are covered by patents assigned to the Secretary of Agriculture.

Assigned patents are available for use by business and industry under either exclusive or non-exclusive licenses. Conditions

applicable to the granting of licenses are set forth in the Federal Register, May 14, 1970 [35(94): 7493-7495]. Further information can be obtained from the Administrator, Agricultural Research Service, U.S. Department of Agriculture, Washington, D.C. 20250.

The Northern Regional Research Laboratory is part of the Agricultural Research Service of the U.S. Department of Agriculture. Congress in 1938 authorized four regional laboratories to conduct broad and complex investigations in the field of chemistry and related physical sciences to expand and improve the marketability of agricultural commodities. A fifth laboratory was completed in 1969 at Athens, Georgia. The addresses and commodities covered are:

<u>Laboratory</u>	<u>Principal Fields of Research</u>
Eastern Regional Research Laboratory 600 East Mermaid Lane Philadelphia, Pennsylvania 19118	Animal fats; dairy products; deciduous fruits; hides and leather; maple sap and sirup; meat and meat byproducts; potatoes and other vegetables.
Northern Regional Research Laboratory 1815 North University Street Peoria, Illinois 61604	Cereal grains: corn, wheat, grain sorghum, barley, and oats; oilseeds: soybean, flaxseed, and erucic acid- containing oilseeds; and new crops.
Richard B. Russell Agricultural Research Center P.O. Box 5677 Athens, Georgia 30604	Southeastern poultry, fruits, and vegetables; pecans and peanuts; forages and feeds; sunflower as an oilseed; pork; and tobacco.
Southern Regional Research Laboratory P.O. Box 19687 New Orleans, Louisiana 70179	Cotton and cottonseed; peanuts; rice; sweet potatoes; and sugarcane.
Western Regional Research Laboratory Berkeley, California 94710	Western fruits, nuts, vegetables, oilseeds, and rice; poultry products; forage crops; wheat and barley; wool and mohair; dry beans and peas; castor; and safflower.



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